ON THE SPOT CRASH INVESTIGATIONS IN THE UK: NEW INSIGHTS FOR VEHICLE SAFETY RESEARCH

Richard Cuerden
Hayley Lunt
Adrian Fails
TRL Limited
United Kingdom
Julian Hill
Loughborough University
United Kingdom
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ABSTRACT

Over 1,000 in-depth, On-The-Spot (OTS) crash investigations have been carried out in the UK since this project was first announced at the 17th ESV conference in Amsterdam. The UK government funds two teams whom routinely attend the scene of road crashes within 15 minutes of incidents occurring. This paper presents an overview of progress to date. The OTS methodology is described and crash examples presented that outline the vehicle, human and highway factors, which are all addressed by the study. This ambitious work is undertaken to allow research to be conducted that will investigate the causes of crashes, their subsequent injuries and the associated societal costs. It is recognised that only through a detailed knowledge of these complex casual factors will effective countermeasures be developed and ultimately successfully applied to improve road transport safety.

INTRODUCTION

Approximately 3,500 people are killed and 40,000 seriously injured every year in the UK as a result of road traffic crashes. The UK government has set targets to engineer a substantial reduction in the injuries and loss of life that result from road crashes by the year 2010. Specifically, by the year 2010, compared with the average for 1994-98, the targets for casualty reductions are (Department for Transport, DfT):

- A 40% reduction in the number of people killed or seriously injured in road accidents;
- A 50% reduction in the number of children killed or seriously injured; and
- A 10% reduction in the slight casualty rate, expressed as the number off people slightly injured per 100 million vehicle kilometres.

In order to develop effective strategies and countermeasures to reduce road crashes and injuries, knowledge of their causes is required. The best source and quality of information is only available at the scene of crashes, minutes after they have occurred. Such, so called, in-depth On-The-Spot (OTS) crash studies, utilise a team of trained Crash Researchers to conduct investigations before the "volatile" evidence has been removed. It is recognised that there are many benefits from collecting crash data simultaneously at the accident scene. In-depth crash investigations are essential for understanding what happens in the real world. Also, much of the information necessary to understand complex road safety questions is found only at the scene.

The OTS investigations allow this "perishable" accident data to be gathered. This includes information relating to trace marks on the highway, pedestrian contact marks on vehicles, the final resting position of the vehicles involved, witness interviews, weather, visibility and traffic conditions. The evidence collected in these vital minutes post the traffic collision allows the investigating team to have a significant amount of knowledge of events before and after the crash. This is used where possible to create a detailed reconstruction of the events leading up to the crash.

This breadth and quality of data then allows a large range of independent and dependent factors to be considered when the investigated crashes are analysed. For example, a research question concerning the cause of pedestrian injuries when in collision with car front structures would rely on detailed knowledge of the cause of injury, (vehicle part or highway), impact speed, actions of pedestrian (walking, running) the relative kinematics and so on. A large amount of this information would also allow analysis of the preventable nature of the collision. For example, what would the driver and pedestrian have seen from their respective viewpoints given their relative travelling speeds and position and known impact point.

Further research questions concerning factors such as the length and type of journey prior to the collision, the highway geometry, the relative crash and subsequent injury severity and so on, are all addressed in the methodology of the project.

Many authors have documented similar studies that are concurrent or have been undertaken historically. In summary, in-depth crash investigations involving scene attendance have been conducted in the UK since the early 1960s. Starks and Miller began crash investigations at TRL, formerly the Transport Road Research Laboratory - TRRL, (DSIR, 1963). Mackay subsequently founded the Accident Research Unit at the University of Birmingham (Mackay, 1969) and established a multidisciplinary team that researched the causes of crashes, the causes of injuries and vehicle crashworthiness. Mackay recognised the need for engineers, medical practitioners and human behavioural scientists jointly to investigate the complex disciplines of accident prevention and the biomechanics of injury.

Further notable work by Mackay and Ashton (Ashton et al. 1977) expanded the University of Birmingham's expertise and focused on at the scene examination of pedestrian crashes. Research from this study included a correlation of vehicle design, impact velocity and injury pattern factors. At this time a team at the TRRL also conducted on-the-spot accident investigations (Sabey et al., 1975) assessing factors that included the causes of crashes. Sabey et al. went on to quantify the role in road accidents of environment, vehicle and human factors.

The current OTS project is collecting data that will, amongst other things, allow the findings of previous work to be evaluated for modern roads, vehicles and traffic conditions. It has been 20 years since detailed in-depth accident data was collected at the scene in the UK.

There are a number of on going OTS road accident investigation studies and some harmonised methodologies available throughout the world (STAIRS, 1998, OECD, 1999). In planning, designing and implementing the UK's OTS project the researchers sought to establish harmonisation with these projects wherever possible. In Europe, in-depth accident databases include the GIDAS project (Otte 1997) and the work of INRETS (Girard, 1993) in currently examining crash causation in Salon de Provence and pedestrian injuries in Lyon. The European Accident Causation Study (EACS) is jointly funded by the European car constructors (ACEA) and the European Commission to study vehicle, road, traffic and human behaviour, together with some attention to the causes of injuries. EACS functions in addition to a number of independent studies conducted by several of the motor manufacturers.

OTS METHODOLOGY

Hill et al. described the OTS methodology in their 2001 ESV paper. The following section is included to give a brief review of the operating procedures and to highlight areas of development.

Objectives

OTS accident data collection has been established with the following objectives;

1. To establish an in-depth research database of a representative sample of road crashes in the United Kingdom.

2. To investigate the causes of crashes and injuries.

3. To assist in the development of accident and injury countermeasures.

The OTS project is sponsored by the UK Government's Department for Transport (DfT) and the Highways Agency (HA), which is an Executive Agency of the DfT. Two teams undertake OTS investigations in England; the locations of the two studies are shown in Figure 1. Five hundred crash investigations and the associated follow-up reconstruction work is undertaken per year.

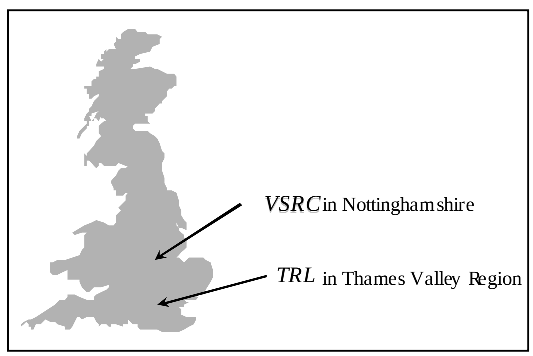

Figure 1. Locations of OTS Investigation Teams.

The Vehicle Safety Research Centre (VSRC) at Loughborough University covers the South Nottinghamshire area in the East Midlands. This includes the city of Nottingham, with an urban population of approximately 267 thousand people. The VSRC's OTS team is based at a police station in the city of Nottingham to allow efficient travel to the scene of crashes.

Figure 2. The VSRC investigation team at work.

The Transport Research Laboratory (TRL) base their OTS team at a police station between Maidenhead and Slough, which is central to the road network within the sample area of the Thames Valley region. This is located in the South East of England.

Figure 3. The TRL investigation team at work.

Figure 4. TRL catchment area.

The catchment areas have fixed geographical boundaries, which enable a sample of crashes to be investigated from within a known population. The areas covered by OTS are completely identifiable by details from local police injury-accident reports, so a clear statistical link is possible. The TRL and VSRC catchment areas are shown in Figures 4 and 5 respectively.

Figure 5. VSRC catchment area.

The OTS crash investigation areas were chosen carefully to ensure that when combined they represented a reasonable estimate of the UK's crash experience, in terms of:

- Road types and environments
- Time of day and year
- Vehicle involvement
- Casualty characteristics

The two sample areas are different in terms of crash involvement and associated characteristics. The VSRC region is more concentrated around an urban city, whereas the TRL area has a greater mixture of towns and rural environments. The difference in road types and socio-economic characteristics of the two regions ensures the teams jointly investigate a representative collection of crashes.

The OTS teams work alongside the Nottinghamshire and Thames Valley Police forces and include a serving police officer on each team who ensures a secure, direct link with the local police command for immediate crash notifications. The efficient and timely notification of crashes is essential for the project to work. Both teams utilise police radio and computer Command and Control systems to ensure immediate response to pertinent incidents. All reported crashes of all severities (including damage only) that occur on public roads within the catchment area when the teams are 'on-call' are investigated where practical.

The two OTS teams use a rotating system of shifts which have been specially devised to ensure that each part of the day and night is covered by the 'on-call' periods. The plan also ensures that the days covered change so that, at the end of the year, the total cases can be statistically weighted to provide frequency estimates that are representative of the complete year.

Specially marked, highly conspicuous response vehicles are used and driven by the trained police drivers. These officers are also highly experienced and extremely knowledgeable road traffic accident investigators.

Data gathered at the scene focuses on:

- All types of vehicles (including damage, failures, features fitted and their contribution).
- The highway (including design, features, maintenance and condition).
- The human factors (including drivers, riders, passengers and pedestrians and, where possible, data on the training, experience and other road user aspects that might have influenced the cause of the crash).
- The injuries sustained.

Further work is necessary after a crash scene has been attended. Information from witnesses not fully questioned at the scene and casualty details are collected where appropriate. The characteristics of those involved in the crash are obtained via questionnaires or interviews. In addition, when possible reconstruction work is undertaken to document the events that lead to and follow the crash scenario. Casualty injury information is collected from hospital records, coroners' reports and questionnaires sent to survivors. The casualties' injuries are coded using the Abbreviated Injury Scale (AIS, AAAM 1990 Revision).

The OTS project requires careful planning and organisation to ensure that the logistics of the investigations and subsequent completed reports are documented fully in the electronic database.

The OTS Database

A full OTS protocol was developed over some two years of preparation in the UK as defined by Morris et al. (1999). This protocol was based on specialist modules prepared by the VSRC at Loughborough University, TRL and The University of Birmingham. The protocol includes a comprehensive system of fields and forms, which define the OTS database, allowing results, and conclusions to be noted for the full range of vehicle, highway and human factors encountered on UK roads. TRL has developed an operational database, which allows the complex data collected from all OTS investigated road traffic accidents to be recorded in an electronic format. The nature of the study has required an 'interactive' data structure where all road users, irrespective of class can be related to one another and their associated crash circumstances (scenes). The hierarchy of the database is as detailed below:

- Scene – Information relevant to the location and environmental conditions (Including traffic density, weather etc).
- Approach – The details of the intended direction of travel of the crash partner (road type, condition, view etc)
- Vehicles – The type of vehicle, nature of damage, number of collisions, state of roadworthiness and so on.
- Humans – The characteristics of those involved in the collision (driver, passenger, gender, age, presence of alcohol etc)
- Injuries – Detailed information coded to AIS1990 for all injured casualties. Injuries are also correlated to their cause.

The Interaction Codes – Cause(s) of the crash

An innovative system has been developed by TRL for the OTS project to define the cause(s) of the crash. This so-called 'Interaction' coding system allows each active road user to be classed by seven different sub-categories. An active road user is defined as anyone who contributes to a crash or is not a passive bystander. Vehicle passengers are rarely contributory. Active road user behaviour could be described as walking into the road or driving the bus that failed to stop at the give-way junction. The sub-categories that comprise each active road users' 'Interaction codes' are:

- Legal – to the team's best interpretation not just related to prosecution (e.g. Disobeyed signs or markings or was legally unfit to drive due to alcohol).
- Perception – Expecting, looking, planning (e.g. Did not look for other vehicle or saw but did not perceive a hazard).

- Judgement – Understanding, deciding, acting (e.g. Interpreted information incorrectly from a road sign or travelled excessively close too).
- Loss of Vehicle-control – For example, due to excessive braking or excessive cornering.
- Conflict – Interpersonal communication (e.g. adopted a path conflicting with that of another road user or behaved aggressively towards another).
- Attention – For example, suffered a distraction due to a mobile phone or was distracted by another road user.
- Impairment – For example, suffered illness or impairment due to fatigue.

Therefore, every active road user is considered against the seven sub-categories and attributed a set of Interaction codes describing their actions that contributed towards the cause of the collision. It is rare for an individual to have more than three codes.

The Interaction sub-categories and examples given above are only a brief overview of the coding system to give an insight into the detailed nature of the data available.

More information on OTS can be accessed from www.ukots.org.

SUMMARY OF CRASHES INVESTIGATED

OTS crash investigations started in late 2000 and under the current phase of the project will continue to mid-September 2003. This first phase of the project will yield a database containing some 1,500 crashes. At the time of writing this paper early analysis of OTS data is providing useful results.

Crash Injury severity	Number	Percentage
Fatal	43	4 *(7)*
Serious	120	11 *(20)*
Slight	448	41 *(73)*
Damage Only	472	44
Total	1083	100

Please note the values in the parenthesis represent the percentage of injury crashes.

Table 1. OTS Investigations by injury severity

Tables 1 and 2 summarise the investigated crashes by both OTS teams at mid-January 2003.

Vehicles are always examined at the scene of the crash and in some circumstances follow-up examinations are conducted when a more thorough evaluation is required. This may be due to lack of available time at the scene, or when particularly complex damage or potential failures may be present

	Number of Vehicles	
Vehicles Involved	**RAGB (2001)**	**OTS 2001 & 2002**
Pedal cycle	19,497 (5%)	47 (2%)
TWMVs	30,084 (7%)	101 (5%)
Cars	321,900 (77%)	1,495 (79%)
Buses or coaches	11,521 (3%)	22 (1%)
Light Goods Vehicles	18,314 (4%)	92 (5%)
Heavy Goods Vehicles	14,813 (4%)	106 (6%)
Other/ Not known	3,944 (1%)	27 (1%)
Total	420,073 (100%)	1,890 (100%)

Table 2. OTS vehicles involved by type

Approximately one hundred crashes involving pedestrians have been attended at the time of writing. This is an example of a casualty type where the two teams have different rates of inclusion due to the different areas sampled.

OTS Team	Number
VSRC	67
TRL	30
Total	97

Table 3. Number of pedestrian casualties in the study (at mid-January 2003).

In Great Britain in 2001 there were 3,450 fatalities, 37,110 seriously and 272,749 slightly injured casualties due to road accidents (RAGB 2001), or 1%, 12% and 87% respectively. Therefore, at first glance it is evident that OTS is slightly over sampling fatal and serious crashes. However, given a known population of crashes from the catchment areas, any such bias can be investigated and accounted for by use of statistical weighting procedures. Fatal crashes generally require more time to investigate and manage by the local emergency services, giving a wider time-window for an OTS team to attend and record valuable data. This greater time and resource often produces more detailed information.

Table 2 details the investigated OTS vehicles by type versus the National figures from Road Accidents Great Britain 2001. There is a reasonable similarity between the national breakdown and those from OTS, both are dominated by car involvement. The inclusion of damage only crashes will effect this comparison as shown in the table, but is easily corrected by only including police reported-injury crashes for statistical comparisons. Similarly, Figure 6 presents the TRL crash investigation rate by time of day of crash, which compares well with the national statistics.

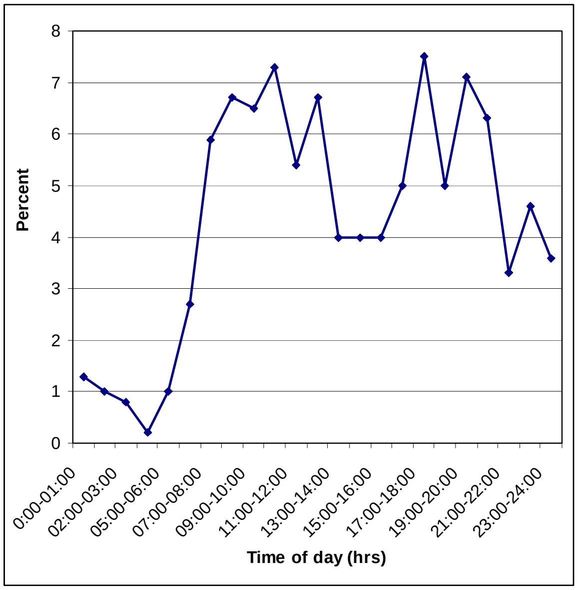

Figure 6. Time of day of OTS crashes investigated.

OTS CRASH EXAMPLES

The rest of the paper presents five examples of OTS crashes investigated by the VSRC and TRL teams. The examples are set out to summarise the findings and highlight the benefits of the on-scene examination process. Due to the space available it is not possible to document all the data recorded for the crashes presented.

Example 1

In December 2002, TRL attended the scene of non-injury multi-vehicle crash at 6:43am, some 13 minutes after it was reported to the police. The incident occurred in Berkshire on a two-lane dual carriageway bridge deck approximately 100m before the road classification becomes a motorway. The approach was a long sweeping left-hand bend and it was dark. The road temperatures prior to and on the bridge were 0°C and -4°C respectively. This presented motorists with a typical example of localised icing of a bridge deck when the approach was not icy. The OTS investigation was able to determine the circumstances in detail and the key collisions are outlined below:

1) The driver of a Fiat Punto was unfamiliar with the area and intended to leave the road and join another major road. As she negotiated the sweeping left-hand bend, a sign came into view, which detailed an upcoming exit slip road. Her reaction was to apply the brakes to slow and allow more time to read the sign. The brakes were applied whilst she was on the bridge deck on a patch of so called 'black ice'. She lost control of the Punto and collided with a Vauxhall Corsa van travelling in the lane to her offside. Both vehicles successfully came to rest on the hard shoulder.

2) Approximately two minutes later, the driver of a Vauxhall Corsa travelling the same route saw the amber flashing hazard lights on the hard shoulder and braked. Unfortunately, the brakes were applied whilst passing over the ice on the bridge, he subsequently lost control of his car and collided with the stationary Corsa van parked on the hard shoulder.

3) A Mazda and Renault travelling in lanes one and two respectively approached the previous crashes and upon seeing the hazard ahead, the Renault driver applied his brakes, lost control upon passing over the ice and collided with the Mazda. The vehicles rotated and come to rest against the crash barrier on the hard shoulder facing the on-coming traffic.

Figure 7. Resultant position of the Renault and the Mazda, neither vehicle has any major structural damage.

4) A driver of a second Mazda swerved to avoid debris in the carriageway and collided with a Vauxhall Omega.

5) The driver of a Volkswagen Polo travelling in lane two saw a car's headlights shining in his direction up ahead. He braked and the vehicle travelling behind collided into the rear of him. The Polo rotated and had impacts with two other vehicles.

Figure 8. The Volkswagen Polo came to rest straddling both lanes of the carriageway. The Rover which avoided the collision can be seen to the right of the picture.

6) A Rover driver saw crash (5) happen ahead of him and swerved to his off side, coming to rest close to the central crash barrier on a grassed area.

The final rest positions of the vehicles were recorded and the participants interviewed on scene.

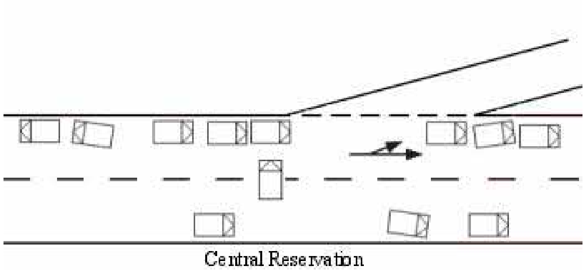

Figure 9. A sketch of the final rest positions of all the vehicles involved.

Crash summary and causation:
Of the twelve drivers involved eleven of them travel this route regularly. They had all been driving more cautiously due to the adverse weather. However this level of caution had decreased upon entering the dual carriageway, as they assumed it would have been gritted. Three of the drivers were aware that there is a greater risk of ice formation on bridge decks, not one of the drivers were actively aware that they were travelling on to a bridge prior to the accident despite regular use of the road.

Although none of the sixteen vehicle occupants was injured the disruption caused was none the less costly and time consuming. Twelve vehicles were involved, six of which needed recovery. Six police officers were occupied with managing the scene and a major road was shut for two and half hours through morning rush hour. All of the collisions involved 'glancing' impacts without any major structural damage to the vehicles involved. It could be reasonably argued that these minor impacts were due to the relative positions of the vehicles on the highway. Had the timing of the impacts been slightly different, the impact severity could have been more severe and that would undoubtedly have increased the risk of more serious injures.

Primarily the weather conditions, specifically the ice on the bridge deck caused the crash. The crash could have been prevented if the road had been gritted more effectively to prevent the formation of ice. Other factors were considered to be road layout and visibility.

Example 2

At 7:53am on an October morning in 2001, the VSRC OTS team attended the scene of a car to motorcyclist impact that had occurred at 7:46am. The crash location was on a major road into Nottingham City centre. Due to the traffic congestion at this peak travel time it was the police's priority to remove the vehicles from the carriageway. In such circumstance it is only by prompt attendance on scene that valuable data can be recorded.

A Volkswagen Polo driver had travelled 50m from her home and was stationary, intending to turn right at a give-way junction from a minor street onto a main road. The traffic flow in the direction she wished to travel was heavy, the traffic flow in the direction that she intended to cross was light.

A bus came to rest at the bus stop prior to the junction on the opposite side of the carriageway and subsequently created a break in the traffic flow from that direction. However, the Polo driver failed to give way to the traffic travelling from the right and pulled out colliding with a motor scooter travelling across her path.

An interview with the driver revealed that she had been travelling for only a few minutes and just prior to the crash was focusing her attention on the congested lane into which she intended to join. She claimed to have glanced to her right and believed the carriageway to be clear before she pulled out. The motorcyclist suffered minor injuries.

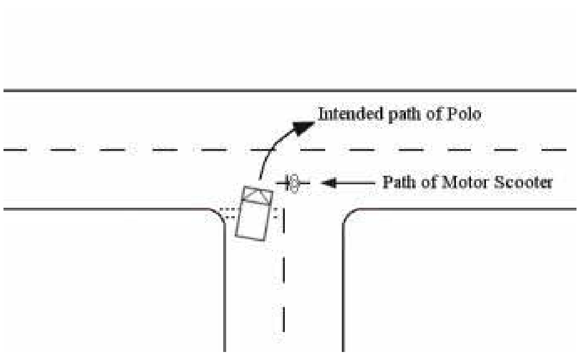

Figure 10. Scene Plan showing direction of travel for both vehicles

Figure 11. Direction of travel of the motorcyclist can be seen as a dried area upon a wet bonnet. Condensation upon the windscreen is also visible

The external surface of the car's bonnet and internal surfaces of the windscreen and side windows were covered with condensed moisture. This is a common phenomenon on early mornings in damp weather conditions and the driver had not attempted to clear the moisture from the glazing before starting her journey. The moisture was seen to limit the driver's vision through front and side glazing.
Upon inspection of the vehicles, it was possible to identify the respective motion and position of the motor scooter and car at the point of impact. The rider of the motor scooter impacted the bonnet of the Polo and removed condensed water from the surface, leaving the diagonal line from the front offside corner to the rear nearside base of the windscreen (Figures 11 and 12). Such perishable data and information such as the rest position of the motorcyclist would be lost if it were not for such rapid on scene attendance.

Crash summary and causation:
Several causation factors were identified, the driver of the Polo's failure to prepare the car safely for the journey, her lack of observation of other road users, and the conspicuity of the scooter rider, who was dressed in dark clothing.

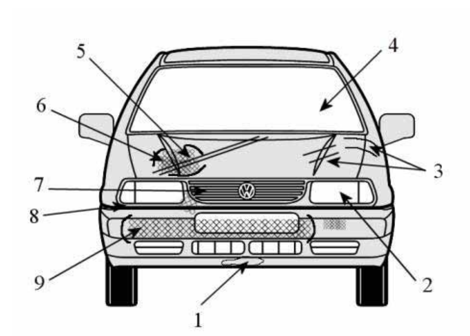

Figure 12. Investigators on scene sketch of contacts and damage

Example 3

On a Sunday afternoon in early January 2002, the TRL OTS team attended the scene of a two-car collision. The weather conditions were fine and the road comprised of two lanes and was straight. The vehicles were found as detailed below (Figure 13).

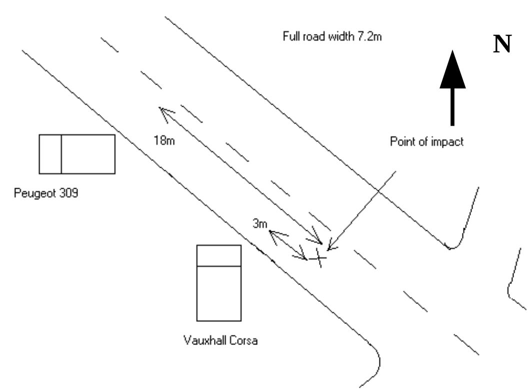

Figure 13. Rest positions of the vehicles.

The Peugeot 309 was travelling in a southeasterly direction and the Vauxhall Corsa was travelling in the opposite direction. Debris in the carriageway was found at the point of impact on the northwesterly, or Corsa's lane. The 22-year-old female driver of the Peugeot 309 admitted to being distracted by the passenger in her car. Upon realising that a vehicle was stationary ahead of her, she braked and lost control of the vehicle. It is believed that she swerved whilst braking and that the wheels were not locked. The 309 rotated clockwise and the veered onto the opposite lane. The front of the Corsa impacted with the front passenger door area of the 309.

Figure 14. Emergency services attending the scene

The uninjured driver of the 309 was a regular user of the car and "quite familiar" with the road. She was approximately 30 minutes into a planned one-hour journey time. She estimates to have been travelling at 40 to 50mph prior to braking.

The male 21-year-old front passenger sustained fractures to his left leg and left wrist. Further soft tissue injuries were also reported. The injuries were attributed to direct contact with intruding passenger door structure.

The 17-year-old learner driver of the Corsa only had a provisional driving licence and was therefore driving under supervision. She had however used the car frequently prior to the crash and knew the road well. She was 20 minutes into a planned 40-minute journey at the time of the crash. She estimates her travelling speed just prior to the crash to have been 40mph and no avoiding action was taken (steering or braking).

The driver of the Corsa sustained fractured ribs with a haemo-pneumothorax and other soft tissue injuries associated with the seat belt webbing. The 55 year-old female front passenger sustained fractures to bones in her left wrist, right ankle, sternum and thoracic spine. She describes herself as bracing before the impact. There was no intrusion to the Corsa's interior.

Crash summary and causation:

All four occupants claimed to have been wearing seat belts and there was evidence found upon inspection of the vehicles, which supported this. The collision was caused primarily due to the inattention of the driver of the 309 not realising vehicles ahead of her were slowing or stationary.

The lack of reaction to avoid the collision by the driver of the Corsa was due to her inexperience. Her colleague had time to brace herself physically and it was thought a more experienced driver might have had time to apply the brakes given the nature of the road and the likely time available.

Example 4

The VSRC OTS team attended a crash that occurred at 14:00hrs in November 2000. The crash location was a single carriageway in an industrial estate. Some building work was being carried out on the site, which resulted in contamination of the road surface with soil.

Figure 15. Contamination of road surface with soil.

An 18-year-old male was driving a Citroen Saxo, with 2 passengers. The driver often used the industrial estate as a short cut. The car drifted onto the opposite carriageway as it travelled around a sweeping right hand bend. Upon approaching the junction the driver attempted to move back onto the correct side of the road, using a combination of steering and braking. Due to his excessive speed and the greasy road surface the driver lost control. The vehicle mounted the grass verge to the near side and rolled through 360° coming to rest on its wheels.

As the vehicle rolled the unrestrained rear seat passenger was ejected, either through the sunroof or the rear hatch. The driver and the front seat passenger were both restrained and suffered only minor injuries, the ejected occupant died as a result of multiple injuries.

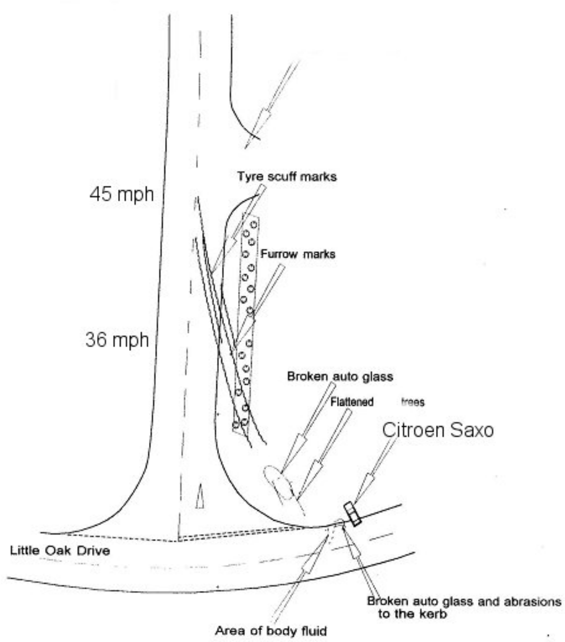

Figure 16. Scene plan, including calculated minimum speeds.

On scene attendance by the OTS team and Nottinghamshire police enabled detailed reconstruction of vehicle speed and motion. This was achieved by use of volatile trace marks left in the mud on the highway surface and on the grass verge, and the rest position of the casualty. From the on scene investigation contributory factors were considered to be excessive speed and contamination of the road surface.

Information gathered after the accident highlighted the young age and relative lack of experience of the driver. The possibility of peer pressure coupled with an increased likelihood of risk taking behaviour due to recent alcohol consumption – although the driver's alcohol level was below the legal limit when tested – were also taken into consideration.

Crash summary and causation:
The crash highlighted the very high risk of injury if occupants are ejected from a vehicle. The use of seatbelts would almost certainly have prevented the ejection and, given the other two occupants' slight injuries, saved the life of the deceased.

Figure 17. Final position of Saxo.

The excessive speed and relative lack of experience of the young driver caused the crash. The contaminated road surface would have made the driver's attempted manoeuvre more difficult to complete successfully.

Example 5

In late October 2001 at midday, the TRL OTS team attended the scene of a single vehicle crash. A Ford Cougar travelling on a motorway with three lanes in each direction had left the carriageway to the nearside. At the point where the Cougar is known to have left the carriageway, the road is a long sweeping left-hand bend. The road and weather conditions were all described as good and the traffic density was light.

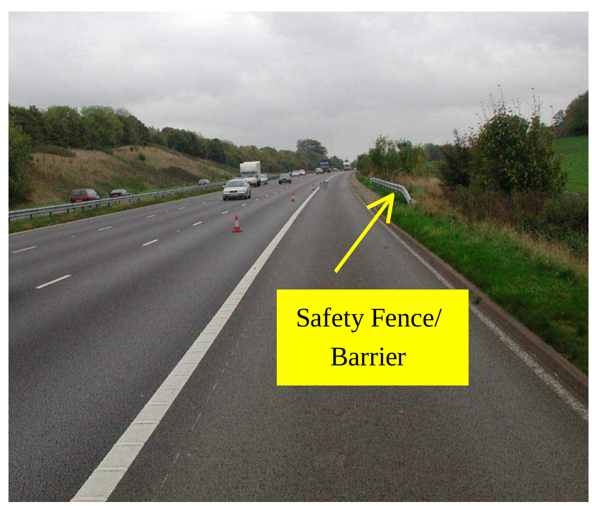

Figure 18. View of motorway, looking in the direction that the Cougar approached from.

The car drifted towards the central reservation and struck the barrier. The driver over corrected making the car yaw and subsequently leave the motorway, narrowly missing a safety fence (shown in figure 18) and travel down a grass embankment. There were tyre marks on the road surface after the impact, which indicated that the car had exceeded the critical speed for completing the intended manoeuvre without losing control.

The involvement of any other vehicle was disregarded following an examination of the car and witness evidence. There were four occupants in the car and a female rear seat passenger complained of neck pain. The remaining occupants reported no injuries.

The 48-year-old male driver and his passengers had all just returned from holiday via a long plane journey (over 7 hours). He had been driving for approximately 30 minutes before the vehicle struck the central barrier.

Crash summary and causation:
The investigating team believed the cause of the crash to have been that the driver fell asleep at the wheel. However, although the driver admitted to being tired, he did not state that he fell asleep.

Figure 19. Ford Cougar as found by OTS team at the bottom of a steep embankment

Fatigue is one of the causes of crashes that we have identified in association with crashes on motorways or other long uncomplicated highways. The background information such as the driver's whereabouts and previous activities in the 24-hours prior to the crash can help identify possible causes such as fatigue, in-depth data is essential to be able to reach these conclusions.

SUMMARY

The UK's On-The-Spot project has been researching the causes of road traffic crashes and the associated injuries for over two years. More than 1,000 crashes have been investigated and documented by the project.

The study successfully collects evidence from the scene of crashes that provides information on factors relating to vehicles, highway and human issues. OTS accurately records what has happened and then, where possible through reconstruction expertise identifies why the crash and injuries occurred. The project is relatively new, but already has a significant database of road traffic crashes that can be analysed.

The database is able to identify the frequency of crashes caused by one or a combination of factors and therefore future effort will be targeted at the most frequent and harmful events witnessed by the study. Continued work to ensure that the data collected are representative of the UK experience will ensure that any countermeasures developed based on OTS research will have a national relevance.

The study does not just consider the cause of crashes. Important data which details the types and mechanisms of injury sustained, especially by vulnerable road users, will enable future engineering countermeasures aimed at reducing injuries should a collision occur to be tuned to the real world experience.

To conclude, the On The Spot study is a major contributor in helping the UK Government meet it's casualty reduction targets by developing an in-depth understanding of accident causes and consequences. The project also aims to give new insights for future vehicle research into effective active and passive safety technologies

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